PANEL DISCUSSION: SESSION I NUCLEAR POWER PLANT MALFUNCTIONS: POTENTIAL TYPES OF EXPOSURE AND SEVERITY*

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DR. NORMAN SIMON: From the viewpoint of the public health, I would like to ask two questions of this panel. First: There has been an avoidance of discussion of the siting of nuclear plants, and some comment ought to be made on that with reference to adjacent populations. Second: With respect to monitoring on the periphery of plants, how far should it be done and what type of monitoring should be carried out?

DR. HENDRIE: The plants are monitored now. The plant licensee is required to have a monitoring system in the neighborhood of the plant which starts well before the plant goes into operation to provide a background history for the area. The monitoring, I might note, is not just for radioactivity, but for a number of environmental effects. Once the plant goes into operation, the licensee monitors the environs outside the plant boundary for radioactivity and other environmental effects, and reports that on a regular basis. For a number of plants, state agencies also conduct independent monitoring.

DR. ROBERT BORES (Nuclear Regulatory Commission): One of the programs initiated by the Nuclear Regulatory Commission about three years ago was a nationwide thermoluminescent dosimetry system. As part of this system, we have approximately 50 thermoluminescent dosimeters placed around each of the operating plants in the country. They are located in each of the sectors that may be populated and are read on a quarterly basis. They provide an independent check of the licensees'

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environmental dosimetry system, supplement it, and routinely monitor releases. In the event of an accident, these devices provide supplementary data to complement those of the licensee and the state.

DR. JOHN MATUSZEK (New York State Department of Health): This whole system installed around plants, whether thermoluminescent dosimeters or direct reading ionization chambers, is a useless exercise as far as an accident is concerned. It is probably useful after the accident to assess what the doses were; and if they were, in fact, low, one can tell the public: "You should not have been worried." As far as actually doing something during an accident, it takes hours to get somebody out in the field to collect the thermoluminescent dosimeters. That can lead to unnecessary exposure for the individual collecting them and takes time. By the time the levels have been read, hours may have been gone by. It is not a predictive capability.

DR. RASMUSSEN: Why do you care whether the monitoring is predictive? If it is known that the radiation is there, one still has time to get people out and save their lives. Therefore it is still very valuable information.

DR. MATUSZEK: I have to work within the guides which say that if the projected dose will exceed 5 rem, I must decide whether or not to move somebody. While I may agree with you philosophically, I cannot within the regulatory context.

DR. LEWIS: Let me make a comment on this exchange, because it illustrates a fairly important point often overlooked within the Nuclear Regulatory Commission, I regret to say. There is a difference between the assurance of safety and adherence to regulation. It is very easy to confuse these two, because very often in an emergency the best thing to do is to depart from the regulations and regulatory guides. In fact, at Three Mile Island it was later determined that the emergency procedures were badly written in some cases and should not have been followed. There is a fundamental debate within the community about the extent to which one ought to depart from regulation in the event of an accident.

DR. BORES: It was never our intent, in putting out a thermoluminescent dosimeter system, to use those data for protective action decision making in plume evacuation situations. I suspect that the toughest battle we shall have to fight is to keep these in the field while the plume is still there. Our dosimeters are used primarily to give some sort of assessment as to the overall radiation levels in the environment. In the event of an accident, they will measure materials that have been released and help to assess an overall population dose.

DR. MATUSZEK: During the Ginna accident, the chairman of the Nuclear Regulatory Commission called the governor of New York and asked to have state people go to the scene of the accident and bring the thermoluminescent dosimeters in from the field while the accident was still going on. It is true that the intended use of these instruments may not be for accident response, but Dr. Simon raised the question of monitoring within a legitimate sense, and we find that the Nuclear Regulatory Commission, as is typical in these accidents, violates their own guidelines as to how the accidents are to be handled.

DR. EDWARD ELKIN (New York State Department of Health): Could the panel suggest various approaches that might increase public confidence in nuclear energy?

DR. RASMUSSEN: I was at a talk recently by Dr. Alvin Weinberg where he pointed out that it took 200 years to stop killing people for witchcraft. So I guess we should not expect that it is easy for the logical side of an argument to win. As you well know, for me to say reactors are safe will not get *New York Times* headlines. And that is an issue we have to fight every day: that the reporting of news focuses on the alarmists, and that makes it very hard to get the message across.

However, I think that in the long run if we are honest, explain the facts as we have come to understand them, do not try to deceive, that the logical argument will win. But we shall have to be patient, and not give up our principles to use the tactics some of our opponents use.

DR. HINKLE: I have a three-part question for the panel: Given a nuclear power plant such as Shoreham or Indian Point, what would be your estimate of the likelihood that any accident that released radiation would occur within 20 years? Second, what would be your estimate of the likely nature and magnitude of this accident? Third, what would be your suggestion as to the most reasonable plans we could make to deal with what we can reasonably expect to occur?

DR. RASMUSSEN: You asked what is the chance that any radioactivity will be released. I do not think you really meant that, because a plant normally operating releases some radioactivity, a very tiny amount. So what you really meant is: What is the chance we shall have an accident? And I have to ask immediately: What size do you mean? Accidents come in all sizes. What we have to do is recognize that there is a whole spectrum of accidents. The less serious accidents are much more likely than the more serious ones, and there are studies that give you curves of just exactly what you have asked for.

DR. HINKLE: I think that is not the way you really operate, Dr. Rasmussen. I recognize that there is some regular release of radiation, but there are also unexpected and undesired releases above these. I gather that these are rather small most of the time, and that small ones are somewhat more frequent. Some of these releases reach a level at which they might be considered a hazard to public health that can be measured by an increase in morbidity or mortality or some other usual measure.

DR. RASMUSSEN: The very worst accident we identified in Wash 1400 created a number of fatalities from latent cancers in the restricted population that was exposed, about an 8% increase in the cancer rate over a 30-year period.

From health statistics, considering the fluctuations in cancer rates, that is just marginally measurable after observing the health statistics for five or 10 years. So the very worst accident, we found, was just on the border of being measurable in the cancer rate. It was easily measurable in the thyroid nodule rates. This type of accident had a probability of about one in a hundred million to one in a billion per year of plant operation. In our study there were essentially no measurable effects at the one in a hundred thousand to one in a million probability per year.

At probabilities of events of one in a hundred thousand to one in a million, one could not measure the health effects by studying the statistics of the population. At some probability lower than one in a million per year, one would begin to be able to observe, first, the thyroid nodules, and next the latent cancers. I shall go one step further. We calculate no effects at frequencies of one in 10,000 per reactor year and higher.

DR. HINKLE: Do I gather from that estimate, then, that the emergency planning for evacuation in this sort of thing is related to a very unlikely probability?

DR. RASMUSSEN: Yes

DR. LEONARD SOLON (New York City Department of Health): In terms of contemporary nuclear science and materials knowledge, how would one contrast the vulnerability to moderate or severe releases of the boiling water reactor configurations with the pressurized water reactor configurations?

DR. RASMUSSEN: We concluded that there was a slightly higher probability that the pressurized water reactor would have a damaging core accident than the boiling water reactor. We further concluded that the containment of the pressurized water reactor was better than the containment of the boiling water reactor, so that one of those effects offset the other and the overall risk from both was well within our band of uncertainty, about the same value, but for slightly different reasons.

In the design there seemed to have been tradeoffs. The boiling water reactors simply have a much smaller volume containment, which breaks more easily under a pressure surge, and that is offset by the fact that the likelihood of certain serious accidents seemed to be less to us.

DR. SOLON: I asked Dr. Hendrie's colleague at a recent meeting of the Metropolitan American Nuclear Society the same question with respect to materials. He essentially agreed that there was a latitude, but he felt that the boiling water reactor was a more favorable configuration in terms of contemporary materials knowledge.

DR. HENDRIE: I think that is correct. The nature of the geometry and the way the boiling water reactor is set up seems less likely to lead to an accident from any core overheating, and hence release of radioactive materials. I think the boiling water reactor emergency core cooling systems are more diverse and reliable, to boot. However, the boiling water reactor containment is smaller and more vulnerable. So they tend to offset. Overall, I think the safety advantage is with the boiling water reactors.

DR. SIMON: I discern a significant amount of discussion concerning monitoring. For those of us who work with radiation and who are interested in public health, I would like to clarify one point. I made that point about monitoring because thermoluminescent detectors and film badges are important as far as the Nuclear Regulatory Commission and other regulatory organizations are concerned. Those of us who think in terms of the dose rate, exposure, and ambient radiation would like to know the dose rate as delivered. The expertise and instrumentation in this field, if it nearly approached the technology we use in taking care of our individual patients, should be able to tell us the immediate dose rate.

DR. LEWIS: I have been asked to summarize what has just happened. I do not think that I can, but there were points that are worth emphasizing.

One point that you may have noticed during the discussion is that nobody was speaking of dramatically imminent danger of major release. That is to say, the conversation centered around whether, even in bad accidents, the release and damage to the public would be measurable. I think that fits into a picture related to the siting question we were going to talk about: that there is a tendency to place too much emphasis on risk in evaluating the importance of things to society. There is more to life than risk. If risk were the only consideration, I would not have gotten onto an airplane to come to New York City for this conference.

For these things in which one discusses conjectural risk, where the risks really are quite low by any measurement, certainly by comparison with alternate means of creating electricity, it is fairly important to get a little bit of perspective and to start thinking about other issues associated with the acceptability or lack of acceptability of a given technology. They go beyond risk. They involve cost. They involve esthetics. They involve environmental issues. They involve all sorts of things. So, just as it is important to keep the level of risk in perspective, I think it is very important to keep risk as a social issue in perspective in evaluating the response to social questions.